Amendments to Specification

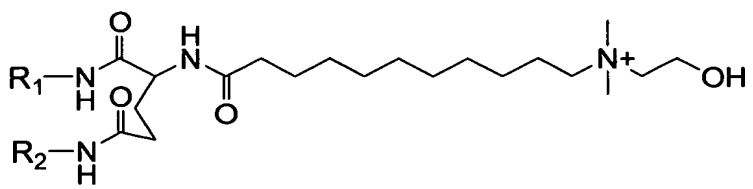
(Translation of substituted pages 3, 4 and 4/1 of the Japanese specification; corresponding to page 3, line 20 to page 6, line 6 of the English specification.)

DISCLOSURE OF THE INVENTION

As a result of intensive research in view of the above object, the inventors have paid attention to the fact that when an amphiphilic compound having a hydrophobic part and a hydrophilic part is self-organized, it grows to have a fibrous structure, thereby forming a gel, which is self-organized at a molecular level, finding that the self-organization of an amphiphilic compound and a monomer interacting with it at a molecular level and the polymerization of the monomer can provide a polymer gel and a cast polymer film having excellent molecular orientation and mechanical strength and high electrical conductivity. The present invention has been completed based on these findings.

Thus, the first molecular-oriented polymer gel of the present invention is obtained by self-organizing a self-organizable amphiphilic compound and a monomer interacting with the amphiphilic compound, and then polymerizing the monomer, which is thiophene and/or its derivative, pyrrole and/or its derivative, or 2-acrylamide-2-methylpropanesulfonic acid.

The second molecular-oriented polymer gel of the present invention is obtained by self- assembly of a self-organizable amphiphilic compound and a monomer interacting with the amphiphilic compound, and then polymerizing the monomer, and the amphiphilic compound is represented by the general formula (I):



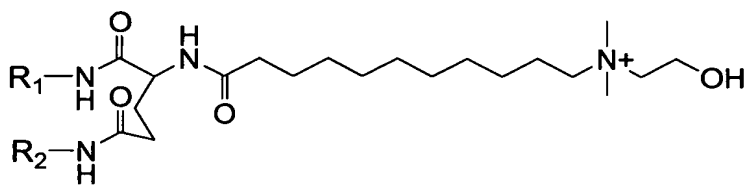
...(I),

wherein R_1 and R_2 represent linear or branched alkyl groups having 20 or less carbon atoms, which may be the same or different.

The first molecular-oriented polymer cast film [according to the first embodiment] of the present invention is obtained by casting a solution of a self-organizable amphiphilic compound and a monomer interacting with the amphiphilic compound, and then polymerizing the monomer, which is thiophene and/or its derivative, pyrrole and/or its derivative, or 2-acrylamide-2-methylpropanesulfonic acid.

The second molecular-oriented polymer cast film [according to the second embodiment] of the present invention is obtained by casting a solution of an amphiphilic compound on an electrode, and then supplying current to the electrode in a solution containing a monomer which is thiophene and/or its derivative, or a monomer which is pyrrole and/or its derivative, to electrochemically polymerize the monomer.

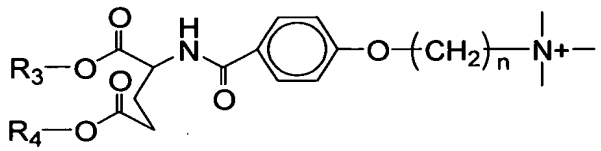
The third molecular-oriented polymer cast film of the present invention is obtained by casting a solution of an amphiphilic compound and a monomer interacting with the amphiphilic compound, and then polymerizing the monomer, and the amphiphilic compound [In the above molecular-oriented polymer gel and cast polymer film, the amphiphilic compound is preferably a cation comprising a linear or branched alkyl group having 20 or less carbon atoms. The cation] is preferably represented by the following general formula (I):



...(I),

wherein R_1 and R_2 represent linear or branched alkyl groups having 20 or less carbon atoms, which may be the same or different.

In the above first molecular-oriented polymer gel and the first and second cast polymer film, the amphiphilic compound is preferably a cation comprising a linear or branched alkyl group having 20 or less carbon atoms. The cation is preferably represented [, or] by the following general formula (II):



... (II),

wherein R_3 and R_4 represent linear or branched alkyl groups having 20 or less carbon atoms, which may be the same or different, and n represents an integer of 2 to 12.

In any molecular-oriented polymer gel and cast polymer film, particularly when the monomer is an anionic monomer such as a monomer containing a sulfonic group, a linear or branched alkyl group of the amphiphilic compound preferably has 10 or less carbon atoms.

In the above second molecular-oriented polymer gel and the third cast polymer film, preferable as the above monomers are thiophene and/or its derivative, pyrrole and/or its derivative, or other anionic monomers than the thiophene derivative and the pyrrole derivative.

Preferable as the thiophene derivative is at least one selected from the group consisting of 3-thiophencarboxylic acid, 3-thiophenacetic acid, 3-thiophene ethanol, 3,4-ethylenedioxythiophene and bis(thiophene). Preferable examples of the pyrrole derivatives include 3-pyrrolecarboxylic acid, 3-pyrroleacetic acid, etc. Preferable examples of the anionic monomers include monomers having sulfonic acid such as 2-acrylamide-2-methylpropanesulfonic acid, 3-thiophencarboxylic acid, 3-thiophenacetic acid, etc. As described above, 3-thiophencarboxylic acid is usable as an anionic monomer, though it is a thiophene derivative.

The method for producing a molecular-oriented polymer gel according to the present invention comprises the steps of mixing a self-organizable amphiphilic compound and a monomer to self-organize them, and then polymerizing the monomer.

The first method for producing a molecular-oriented polymer cast film [according to the first embodiment] of the present invention comprises the steps of preparing a solution of a self-organizable amphiphilic compound and a monomer interacting with the amphiphilic compound, casting the solution, and then polymerizing the monomer.

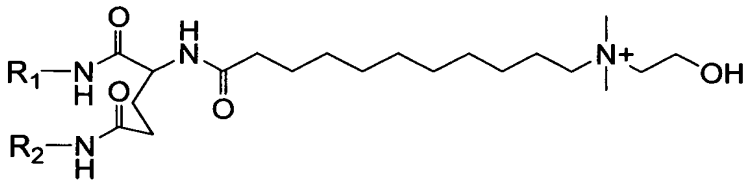
The second method for producing a molecular-oriented polymer cast film [according to the second embodiment] of the present invention comprises the steps of casting a solution of an amphiphilic compound on an electrode, dried the solution to form a film, immersing the film on the electrode in a monomer solution, and supplying current to the electrode to electrochemically polymerize the monomer.

Amendments to Claims

1. A molecular-oriented polymer gel obtained by self-assembly of a self-organizable amphiphilic compound and a monomer interacting with said amphiphilic compound, and then polymerizing said monomer, said monomer being thiophene and/or its derivative, pyrrole and/or its derivative, or 2-acrylamide-2-methylpropanesulfonic acid.

2. The molecular-oriented polymer gel according to claim 1, wherein said amphiphilic compound is a cation comprising a linear or branched alkyl group having 20 or less carbon atoms.

3. A molecular-oriented polymer gel obtained by self-assembly of a self-organizable amphiphilic compound and a monomer interacting with said amphiphilic compound, and then polymerizing said monomer, said amphiphilic compound being [The molecular-oriented polymer gel according to claim 2, wherein said cation is] represented by the following general formula (I):



... (I),

wherein R_1 and R_2 represent linear or branched alkyl groups having 20 or less carbon atoms, which may be the same or different.

4. The molecular-oriented polymer gel according to claim 3, wherein said monomer is thiophene and/or its derivative, pyrrole and/or its derivative, or 2-acrylamide-2-methylpropanesulfonic acid, or another anionic monomer than said thiophene derivative and said pyrrole derivative [an anionic monomer].

5. The molecular-oriented polymer gel according to claim 4, wherein said anionic monomer comprises a sulfonic group.

6. The molecular-oriented polymer gel according to claim 5, wherein said anionic monomer is 2-acrylamide-2-methylpropanesulfonic acid.

7. The molecular-oriented polymer gel according to any one of claims 2 to 6, wherein the linear or branched alkyl group of said amphiphilic compound has 10 or less carbon atoms.

8. (Canceled)

9. The molecular-oriented polymer gel according to any one of claims 1, 2, 4 and 7 [claim 8], wherein said thiophene derivative is at least one selected from the group consisting of 3-thiophencarboxylic acid, 3-thiophenacetic acid, 3-thiophene ethanol, 3,4-ethylenedioxythiophene and bis(thiophene), and wherein said pyrrole derivative is 3-pyrrolecarboxylic acid or 3-pyrroleacetic acid.

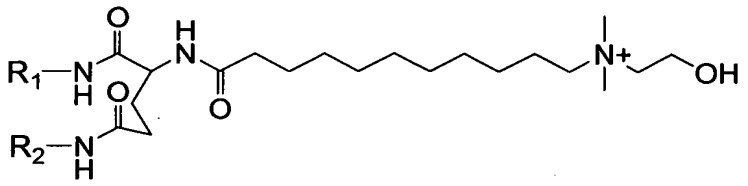
10. A molecular-oriented polymer cast film obtained by casting a solution of a self-organizable amphiphilic compound and a monomer interacting with said amphiphilic compound, and then polymerizing said monomer, said monomer being thiophene and/or its derivative, pyrrole and/or its derivative, or 2-acrylamide-2-methylpropanesulfonic acid.

11. A molecular-oriented polymer cast film obtained by casting a solution of a self-organizable amphiphilic compound on an electrode, and then supplying current to said electrode in a solution containing a monomer which is thiophene and/or its derivative, or a monomer which is pyrrole and/or its derivative, to electrolytically polymerize said monomer.

12. The molecular-oriented polymer cast film according to claim 10 or 11, wherein said amphiphilic compound is a cation comprising a linear or branched alkyl group having 20 or less carbon atoms.

13. A molecular-oriented polymer cast film obtained by casting a solution of a self-organizable amphiphilic compound and a monomer interacting with said amphiphilic compound, and then polymerizing said monomer, said

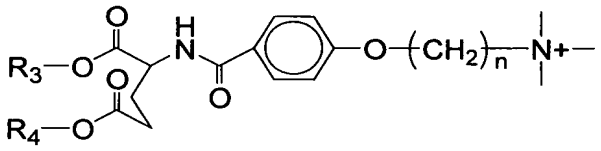
amphiphilic compound being [The molecular-oriented polymer cast film according to claim 12, wherein said cation is] represented by the following general formula (I):



... (I),

wherein R_1 and R_2 represent linear or branched alkyl groups having 20 or less carbon atoms, which may be the same or different.

14. The molecular-oriented polymer cast film according to claim 12, wherein said cation is represented by the following general formula (II):



... (II),

wherein R_3 and R_4 represent linear or branched alkyl groups having 20 or less carbon atoms, which may be the same or different, and n is an integer of 2 to 12.

15. The molecular-oriented polymer cast film according to claim 13 [any one of claims 10, 12 to 14], wherein said monomer is thiophene and/or its derivative, pyrrole and/or its derivative, or another anionic monomer than said thiophene derivative and said pyrrole derivative.

16. The molecular-oriented polymer cast film according to claim 15, wherein said anionic monomer other than said thiophene derivative and pyrrole derivative is 2-acrylamide-2-methylpropanesulfonic acid.

17. The molecular-oriented polymer cast film according to any one of claims 10 to 12, 14 and [claim] 15, wherein said thiophene derivative is at least one selected from the group consisting of 3-thiophencarboxylic acid, 3-thiophenacetic acid, 3-thiophene ethanol, 3,4-ethylenedioxythiophene and bis(thiophene), and wherein said pyrrole derivative is 3-pyrrolecarboxylic

acid or 3-pyrroleacetic acid.

18. A method for producing the molecular-oriented polymer gel recited in any one of claims 1 to 7 and 9, comprising the steps of mixing said amphiphilic compound and said monomer to self-organize them, and then polymerizing said monomer.

19. The method for producing a molecular-oriented polymer gel according to claim 18, wherein the polymerization reaction of said monomer is carried out at a temperature lower than a phase transition temperature of a self-organized-to-molecular-level body of said amphiphilic compound and said monomer.

20. A method for producing the molecular-oriented polymer cast film recited in any one of claims 10 to 17, comprising the steps of preparing a solution of said amphiphilic compound and said monomer, casting said solution, and then polymerizing said monomer.

21. A method for producing the molecular-oriented polymer cast film recited in any one of claims 10 to 17, comprising the steps of preparing a solution of said amphiphilic compound, casting said solution on an electrode, dried said solution to form a film of said amphiphilic compound, immersing said film in a solution comprising said monomer, and supplying current to said electrode to electrolytically polymerize said monomer.

22. The method for producing a molecular-oriented polymer cast film according to claim 20 or 21, wherein the polymerization reaction of said monomer is carried out at a temperature lower than a phase transition temperature of a self-organized-to-molecular-level body of said amphiphilic compound and said monomer.